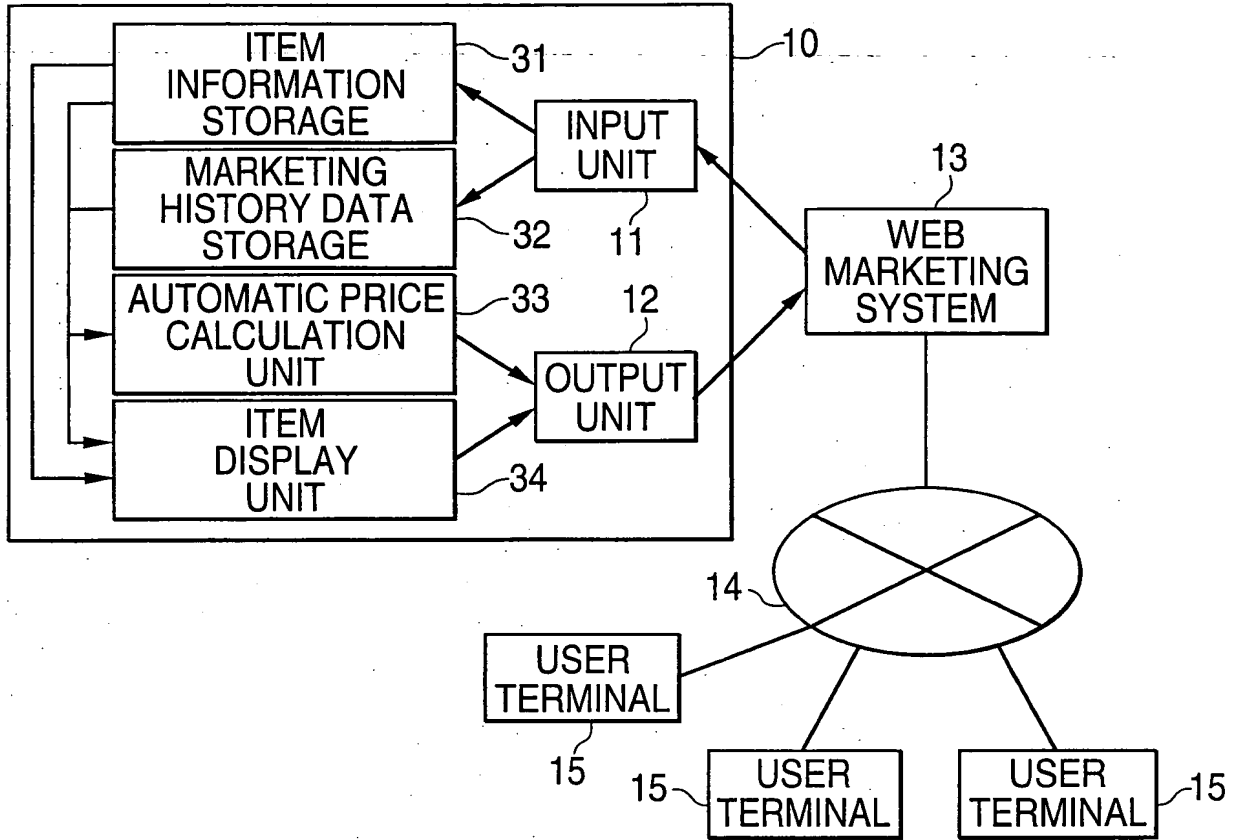
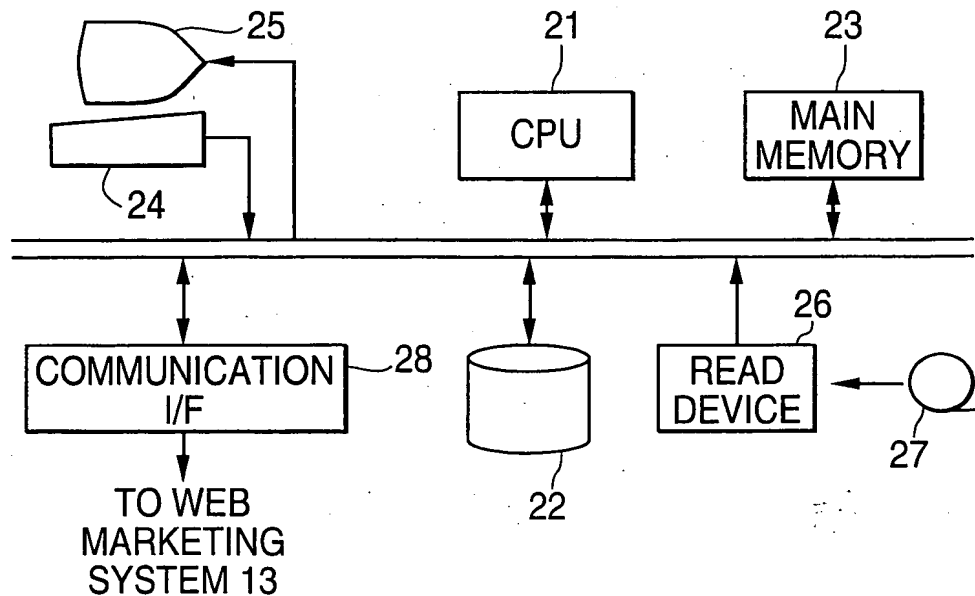


**FIG. 1**



**FIG. 5**



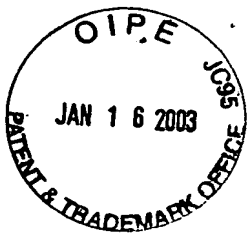


## FIG. 2

Algorithm: **StochPrice**

( $P_{init}$ : Initial Price,  $T$ : Unit sales period)

1. Initialization
  - 1.1. Initial price:  $p := P_{init}$
  - 1.2. Initial time:  $t := \text{current time}$
  - 1.3. Initial setting of trial number:  $I := 1$
2. **Repeat For**  $I = 1$  until forever
  - 2.1. Set  $\Delta$  as follows:  $\Delta := I^{-1/3}$
  - 2.2. For a period of  $T$ , set price to  $p + \Delta$
  - 2.3. Let  $S(p+\Delta)$  be the amount of sales during this time.
  - 2.4. For a period of  $T$ , set price to  $p - \Delta$
  - 2.5. Let  $S(p-\Delta)$  be the amount of sales during this time.
  - 2.6. Calculate the obtained profit as follows:
$$P(p+\Delta) = S(p+\Delta) \cdot (p+\Delta)$$
$$P(p-\Delta) = S(p-\Delta) \cdot (p-\Delta)$$
  - 2.7. Set the update interval  $A$  as follows:
$$A := \frac{1}{I}$$
  - 2.8. Update the current price as follows:
$$p := p + \frac{A}{\Delta} \frac{P(p+\Delta) - P(p-\Delta)}{2T}$$
  - 2.9. If necessary, clamp the value of  $p$  between the maximum and minimum possible prices.
$$p := \min\{p_{\max} - \Delta, \max\{p_{\min} + \Delta, p\}\}$$
  - 2.10. Update current time  $t$ .
$$t := t + 2T$$
  - 2.11. Store current time  $t$ , price  $p$  and sales  $S(p) = S(p+\Delta) + S(p-\Delta)$  to the database.



## FIG. 3

Algorithm: **FeaturePrice**

( $W_{init}$  : Initial weight vector,  $T$  : unit sales period)

1. Initialization
  - 1.1. Initial weight vector:  $W := W_{init}$
  - 1.2. Initial time:  $t := \text{current time}$
2. **Repeat For**  $I = 1$  until forever
  - 2.1. **For** item  $i = 1$  until  $N$  (number of item)
    - 2.1.1.  $X(i) := \text{attribute vector for item } i$
    - 2.1.2.  $P(i) := W \cdot X(i)$
    - 2.1.3.  $\Delta := I^{-1/3}$
    - 2.1.4.  $\bar{V}(i) = \text{Random-vector } ()$
    - 2.1.5.  $\bar{\Delta}(i) = \Delta \cdot (\bar{V}(i) / |\bar{V}(i)|)$
    - 2.1.6. Set current price for item  $i$  as follows:  
 $p(i) := \{W + \bar{\Delta}(i)\} \cdot X(i)$
    - 2.1.7. For each item  $i$ , If  $p(i)_{min} > (W + \bar{\Delta}(i)) \cdot X(i)$  or  
 $p(i)_{max} < (W + \bar{\Delta}(i)) \cdot X(i)$  then select maximum  
 positive constant  $\pi$  which satisfies the  
 following equation and put  $\bar{\Delta}(i) := \pi \bar{\Delta}(i)$  :  
 $p(i)_{min} \leq (W + \pi \bar{\Delta}(i)) \cdot X(i) \leq p(i)_{max}$
  - 2.2. For a time period of  $T$ , set the price of each item ( $i$ )  
 to  $p(i) := (W + \bar{\Delta}(i)) \cdot X(i)$  and conduct sales.
  - 2.3. Let  $S(W + \bar{\Delta}(i))$  be amount of sales thus obtained for  
 each time ( $i$ ).
  - 2.4. For a time period of  $T$ , set the price of each item ( $i$ )  
 to  $p(i) := (W - \bar{\Delta}(i)) \cdot X(i)$  and conduct sales.
  - 2.3. Let  $S(W - \bar{\Delta}(i))$  be amount of sales thus obtained for  
 each item ( $i$ ).
  - 2.6. For each item  $i$ , calculate total profits based on  
 the above amount of sales.  
 $P(W + \bar{\Delta}(i)) = S(W + \bar{\Delta}(i)) \cdot X(i) (W + \bar{\Delta}(i))$   
 $P(W - \bar{\Delta}(i)) = S(W - \bar{\Delta}(i)) \cdot X(i) (W - \bar{\Delta}(i))$
  - 2.7. **For**  $i = 1$  until number of items  
 Update the weight vector  $W$  as follows:  

$$W := W + \frac{A}{|\bar{\Delta}(i)|} \frac{P(W + \bar{\Delta}(i)) - P(W - \bar{\Delta}(i))}{2T}$$
  - 2.8. Update current time  $t$ .  
 $t := t + 2T$
  - 2.9. Store current time  $t$ , price  $p$  and  
 $S(p) = S(W - \bar{\Delta}(i)) + S(W + \bar{\Delta}(i))$  to the database.



## FIG. 4

Algorithm: **VarietySelection**

(W : weight vector, G : set of items, n : number of items to be displayed, N : Number of iterations)

1. Initialization
  - 1.1. Sort G in increasing order of PTotal (i,W)
  - 1.2.  $S := \text{First} - n(G, n)$
  - 1.3.  $\bar{S} := G \setminus S$
2. **Repeat for**  $i = 1$  until N
  - 2.1. Randomly select item  $j \in S$ .
  - 2.2. If there exists item k such that exchanging j, k would result in increasing the evaluation value of  $\sum_{i \in S} \lambda_1 \text{PTotal}(i, W) + \lambda_2 H(S)$  then make that exchange and update S and  $\bar{S}$ .
3. Output S.